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NEW FOSSIL CYPRAEIDAE FROM THE MIOCENE OF FLORIDA AND COLOMBIA*

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THREE EXTINCT species of Cypraeidae from the Miocene of Alum Bluff, Calhoun County, Florida, and two extinct species from Miocene strata in the vicinity of Tuberá, Colombia, are herein described.

These new Cypraeidae from Florida bring the total of recognized species and subspecies of extinct fossil Cypraeidae described from North America to forty-two (Ingram, 1942). The Colombian species described here were referred to by Anderson (1929) in his work on the marine Miocene of northern Colombia. He considered them both to be *Cypraca henekeni* Sowerby (Sowerby, 1850).

The writer wishes to express his thanks to Dr. G. Dallas Hanna and to Dr. Leo George Hertlein of the Department of Paleontology of the California Academy of Sciences, who allowed the writer to examine the collections of Cypraeidae in that institution, and who for a number of years have extended every courtesy to the writer in his conchological work. The writer also wishes to express his appreciation to Dr. Herbert W. Graham, Professor of Biology at Mills College, for making the illustrations of the holotype specimens.

FLORIDA SPECIES

Cypraea hertleini Ingram, new species

Plate 2, figures 1, 2

Shell bulbous, sloping steeply in lateral profile from the dorsum toward the anterior and posterior canals; spire obscured; sides of shell calloused; callosity of sides extends over lateral margins of dorsum, leaving an undu-

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lating pattern on top of the dorsum; pattern superficially recalls the dorsal pattern of *Cypraca spadicea* Swainson; a 4 mm. wide shelf is present dorsally over anterior canal, shelf lacking over posterior canal; base convex, upturned at lateral margins, leaving a barely visible ridge at dorsal margin of upturned basal sides, and recalling a similar condition in *Cypraca arenosa* Gray; anterior canal extremity straight ventrally, strongly curved to the left dorsally; posterior canal turned toward the left; anterior canal lips of equal length; anterior canal 3 mm. broad by 4 mm. wide; terminal ridge of anterior canal sunken; anterior region of outer lip declivous; outer lip teeth approximately 4 mm. long; outer lip teeth along anterior one-half of lip have interstices of approximately 1 mm.; along posterior one-half interstices are approximately 1.50 mm. wide; anterior columellar teeth over anterior two-fifths of lip exist as nodules, the longest two extending 2 mm. into the aperture on the columella of the shell; three poorly developed non-noduled teeth are present on the central fifth of the columella; posterior two-fifths of the columella without teeth; barely noticeable depression on columella just posterior to the terminal ridges; columella from terminal ridge to approximately mid-point of its length slightly concave; columella from mid-point to posterior extremity convex; columellar surface just behind terminal ridge approximately 10 mm. deep; aperture 5 mm. wide anteriorly just behind terminal ridge, and narrowing posteriorly to 3 mm. just in front of posterior canal. The type measures: length, 40 mm.; breadth, 29.50 mm.; height, 22.50 mm.

Holotype, No. 8044, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about twenty feet above the water level, on the left bank of the Apalachicola River, about three and one-half miles above Bristow, at **Alum Bluff on Apalachicola River, Calhoun County, Florida**; E. L. Packard, collector. Lower Miocene.

Discussion: Preservation in the holotype is excellent. The outer layer of the shell is nearly intact except where sand grains have made small, narrow, longitudinal furrows over the central region of the dorsum. The shell color is faded, but evidence is present to indicate that while living this species possessed four color zones: a broad basal zone, a broad lateral zone, a line color zone that bounded the dorsal designs, and the dorsal design. The line color zone exists in the holotype as an orange-brown line; the color from the other zones has faded.

This species is named for Dr. Leo George Hertlein, Assistant Curator, Department of Paleontology, California Academy of Sciences, who has untiringly given his time to aid the writer.

Cypraea apalachicolae Ingram, new species

Plate 2, figures 6, 8

Shell bulbous, sloping steeply in lateral profile toward the anterior canal; posteriorly the slope is marked by a broadly open concavity above the outer lip side of the shell; calloused base; callosity of the base extends up to the

lateral margins, recalling a similar condition in *Cypraea arenosa* Gray; dorsum unornamented; dorsal shelf over anterior canal 5 mm. wide; shelf absent over posterior canal; base convex; upturned lateral margins of base leave a series of small, smooth, barely discernible nodules on the outer lip side of base; nodules lacking on outer surface of columella side of base; anterior canal straight ventrally and dorsally; posterior canal turned toward the left; terminal ridge of anterior canal sunken; anterior region of outer lip declivous; outer lip teeth approximately 5 mm. long; teeth along anterior one-half of outer lip have interstices of approximately 1 mm., along posterior one-half of approximately 1.50 mm.; anterior columellar teeth over anterior two-fourths of columella well developed, nodule-like; those of third fourth extremely small, barely visible; those over posterior one-fourth well developed, nodule-like; columella teeth longest over anterior one-fourth, extending 3 mm. into the aperture; strong depression visible on interior columellar surface posterior to terminal ridge; columella from terminal ridge caudad one-third, strongly concave; columella strongly convex over posterior two-thirds; concave surface of columella is produced enough to be considered a toothless fossula; aperture 3 mm. wide just behind posterior canal, 5 mm. wide anteriorly over fossula. The type measures: length, 48 mm.; breadth, 37 mm.; height, 28 mm.

Holotype, No. 8045, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about twenty feet above the water level, on the left bank of the Apalachicola River, about three and one-half miles above Bristow, at **Alum Bluff on Apalachicola River, Calhoun County, Florida**; E. L. Packard, collector. Lower Miocene.

Discussion: The outer layer of the shell is missing from the posterior and lateral two-thirds of the shell. A piece is broken from behind the terminal ridge on the anterior columellar base of the shell. No dorsal pattern is present on the part of the dorsum remaining intact.

This species is related to *C. hertleini* Ingram, but it differs from that species in possessing a defined, toothless fossula, in having a straight anterior canal ventrally and dorsally, in possessing teeth along the entire columella, in lacking an ornamented dorsum, and in that the posterior canal is produced.

Cypraea alumensis Ingram, new species

Plate 2, figures 3, 4

Shell ovate, sloping gently in lateral profile toward the anterior and posterior canals; shelves over both canals, anterior one 2 mm. broad, posterior one 4 mm. broad; lateral margins calloused; base calloused, convex, angled upward at its union with shell sides; terminal ridge extends directly back from columellar side of aperture and bends dorsad into shell; fossula absent; anterior canal straight ventrally, curved to left dorsally, 1.50 mm. wide and 3.50 mm. long; posterior canal slightly curved to the left, 2 mm. wide and 4 mm. long; outer lip teeth declivous at anterior extremity; outer lip teeth with interstices of approximately .50 mm., confined to the aperture, and extending

dorsad around lip into shell; teeth very minute caudad on outer lip, and extending on to posterior canal; first anterior columella tooth very elongate, narrow, next two nodule-like, remainder of teeth elongate, fine with broader interstices than those of anterior three teeth. The type measures: length, 28.50 mm.; breadth, 20.50 mm.; height, 14.50 mm.

Holotype, No. 8043, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about twenty feet above the water level, on the left bank of the Apalachicola River, about three and one-half miles above Bristow, at **Alum Bluff on Apalachicola River, Calhoun County, Florida**; E. L. Packard, collector. Lower Miocene.

Discussion: The shell is moderately eroded; no indication of its original color remains. The aperture area and the lips are intact.

Discussion of Fossil Relationships of Florida Species

Aside from the relationship of *Cypraea hertleini* Ingram and *Cypraea apalachicolae* Ingram, pointed out in the foregoing, these two species are quite distinct from other Cypraeidae of the Western Hemisphere. Superficially they recall the extinct lower Miocene species, *Cypraea chilona* Dall, from the Chipola Beds, Alum Bluff, Florida (Dall, 1900; Ingram, 1939, 1942). However, the columellar teeth are not so well developed in *C. chilona;* the shell is flattened dorsoventrally; there is a flange on the columellar side of the anterior canal; and the shelf over the anterior canal is absent.

Cypraea alumensis Ingram bears relationship to *Cypraea heilprini* Dall from Ten Mile Creek, Calhoun County, Florida (Dall, 1890). This extinct lower Miocene species differs from *C. alumensis,* however, by possessing unequal posterior canal lips, by having the outer lip teeth extend over the lip and not confined to the aperture, and by lacking well-defined differentiation of the columellar teeth. Dall (1890) in describing *C. heilprini* likened this species to *Cypraea pinguis* Conrad.

Cypraea alumensis also shows affinity to *Cypraea ballista* Dall, from the Miocene of the Tampa Silex beds at Ballast Point, Tampa Bay, Florida; it differs, however, in having the outer lip teeth more nearly confined to the aperture; in lacking the widened aperture area just posterior to the terminal ridge; in having well-defined columellar teeth along the anterior one-fourth of the columella; and in having the posterior canal strongly curved to the left rather than being straight.

Cypraea alumensis Ingram is, in several characteristics, likewise similar to the living West Coast species, *Cypraea robertsi* Hidalgo, except in lacking a toothed fossula; in having the columellar teeth more nearly confined to the aperture, of a different shape, and more numerous; and in having a more produced posterior canal. Distributional records of the living species indicate that it is found at: Colombia; Taboga Island, Panama; Pacific side of the Canal Zone; Gulf of Fonseca between Costa Rica and Nicaragua; Concepción Bay and La Paz, Lower California; and Guaymas, Sonora, Mexico.

Other extinct Florida species, described from the Miocene, are quite distinct from those discussed above. Such species are *Cypraca carolinensis floridanus* Mansfield described from the Tamiami Trail, forty-two miles west of Miami, Florida, by Mansfield (1931), and *Cypraca tumulus* Heilprin from Ballast Point, Hillsboro Bay, Florida, a species that Dall (1890) considered to be a synonym of *C. pinguis*, but referred to as a valid species when he described *C. ballista*, discussed above (Dall, 1915).

Colombian Species 3

Cypraea andersoni Ingram

Plate 2, figures 5, 7

Shell heavy with a high dorsum, in lateral profile sloping gradually toward the anterior and steeply toward the posterior canal; posterior canal produced 5 mm., sides flaring out at free extremity; two nearly obscured protuberances on dorsum just anterior to the central transverse axis of dorsum; base convex and upturned on its lateral margins; anterior canal not produced, and minute for size of mollusk, 3 mm. long by 3 mm. broad, curved to the left; terminal ridge sunken, sloping immediately into shell aperture; fossula absent; anterior region of outer lip notably constricted; outer lip teeth run from anterior end of constricture to beginning of posterior canal; teeth with interstices of from 1 to 1.50 mm. broad, teeth curved around lip into shell; columellar teeth elongate, running into aperture on columella, interstices from 1 to 2 mm. broad; longest columellar teeth from 3 to 5 mm., in central columellar region; posterior columellar teeth poorly developed, as slightly raised lines; teeth on both lips confined to the aperture; aperture curves to the left anteriorly and posteriorly; aperture 8 mm. broad just behind terminal ridge, and 5 mm. broad just in front of posterior canal. The type measures: length, 60 mm.; breadth, 44 mm.; height, 32 mm.

Holotype, No. 8042, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 267B (C.A.S.), Tuberá Hill at west base of Tuberá Mountain, in the lower part of the Tuberá group, **1 mile west of Tuberá, Colombia**; Frank M. Anderson, collector. Middle Miocene.

Discussion: The holotype is moderately eroded dorsally; the shell is not fragmented. By scraping the sand matrix from its interior the characteristics of the teeth, canals, and aperture were revealed.

This species is named for the late Dr. Frank M. Anderson, Honorary Curator, Department of Paleontology, California Academy of Sciences.

Cypraea tuberae Ingram

Plate 2, figures 9, 12

Shell heavy with a high dorsum, in profile sloping steeply immediately into the posterior canal notch, and sloping gradually toward the anterior canal; sides are streaked in brown, recalling the condition in *Cypraca mus* Linnaeus;

one tubercle present on right of dorsum just above and to the right of the posterior canal notch; base flat, upturned at lateral margins but slightly; line of base demarcation well developed at lateral margins; posterior canal notch 8 mm. deep; distally free extremities of notch constricted (i.e., notch 8 mm. wide at base, and 5 mm. wide at free extremities); anterior canal bounded by two fractured flanges, remnants of right flange 8 mm. wide, of left flange 12 mm. wide; aperture curved to the left anteriorly and posteriorly; aperture has maximum width, 7 mm., just posterior to terminal tooth, and is narrowest, 5 mm., just behind posterior canal; teeth on anterior margin of outer lip declivous; outer lip teeth interstices from 1.50 to 2 mm.; teeth on anterior one-half of outer lip elongate, on posterior one-half nodule-like; columellar teeth longest at anterior and posterior regions of columella, approximately 5 mm. long, shortened in the columellar center to 2 to 3 mm. The type measures: length, 64 mm.; breadth, 47.50 mm.; height, 35 mm.

Holotype, No. 8041, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 267B (C.A.S.), Tuberá Hill at west base of Tuberá Mountain, in the lower part of the Tuberá group, **1 mile west of Tuberá, Colombia**; Frank M. Anderson, collector. Middle Miocene.

Discussion: Color markings are partially preserved, indicating that the base and lateral surfaces were probably brown. The outer shell layer on the left posterior region of the dorsum has been broken away, possibly carrying away one tubercle, since one remains, and such protuberances in the Cypraeidae are typically bilateral. The shell would have a greater length if a part of the flanges on either side of the anterior canal had not been broken away.

Discussion of Relationships of the Colombian Species

Cypraea andersoni and *Cypraea tuberae* described in the foregoing belong to the "*Cypraea henekeni* Sowerby group" of Cypraeidae. Evidence indicates that the "*C. henekeni* group" may generally denote the presence of approximately Miocene strata. Of the nine species and subspecies of the related Cypraeidae belonging to this group in the Western Hemisphere, all but one are of Miocene occurrence, and the authors of this one exception, *Cypraea cayapa* Pilsbry and Olsson (1941), state in describing their species from the Pliocene of Ecuador that it possibly belongs to "an older fossiliferous series." The extinct species of the Western Hemisphere related to the two new Colombian species appear to be: *Cypraea almirantensis* Olsson (1922) from Water Cay, Panama, Gatun Stage, middle Miocene; *Cypraea angustirima* Spieker (1922) from the lower Zorritos, Quebrada Zapotal, Peru, middle Miocene; *Cypraea henekeni* Sowerby (1850) from Santo Domingo, middle Miocene; *Cypraea henekeni potreronis* Ingram (1939) from Rio Amina near Potrero, Provincia de Santiago, Santo Domingo, Gurabo formation, middle Miocene; *Cypraea noueli* Maury (1917) from Cercado de Mao, Santo Domingo, middle Miocene; and *Cypraea henekeni amandusi* Hertlein and Jordan (1927) from San Ignacio Arroyo, southwest of San Ignacio, Lower California, Isidro formation,

middle Miocene. Of these species, *C. almirantensis* Olsson is unusually elongate as the holotype figure indicates, and does not have the typical shape of the other species in the *C. henekeni* group.

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PLATE 2

FIGS. 1–2.—*Cypraca hertleini* Ingram, new species. Length, 40 mm., breadth, 29.50 mm., height, 22.50 mm. Holotype, No. 8044, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about 20 feet above the water level, on the left bank of the Apalachicola River, about 3½ miles above Bristow, at Alum Bluff on Apalachicola River, Calhoun County, Florida; lower Miocene. P. 125.

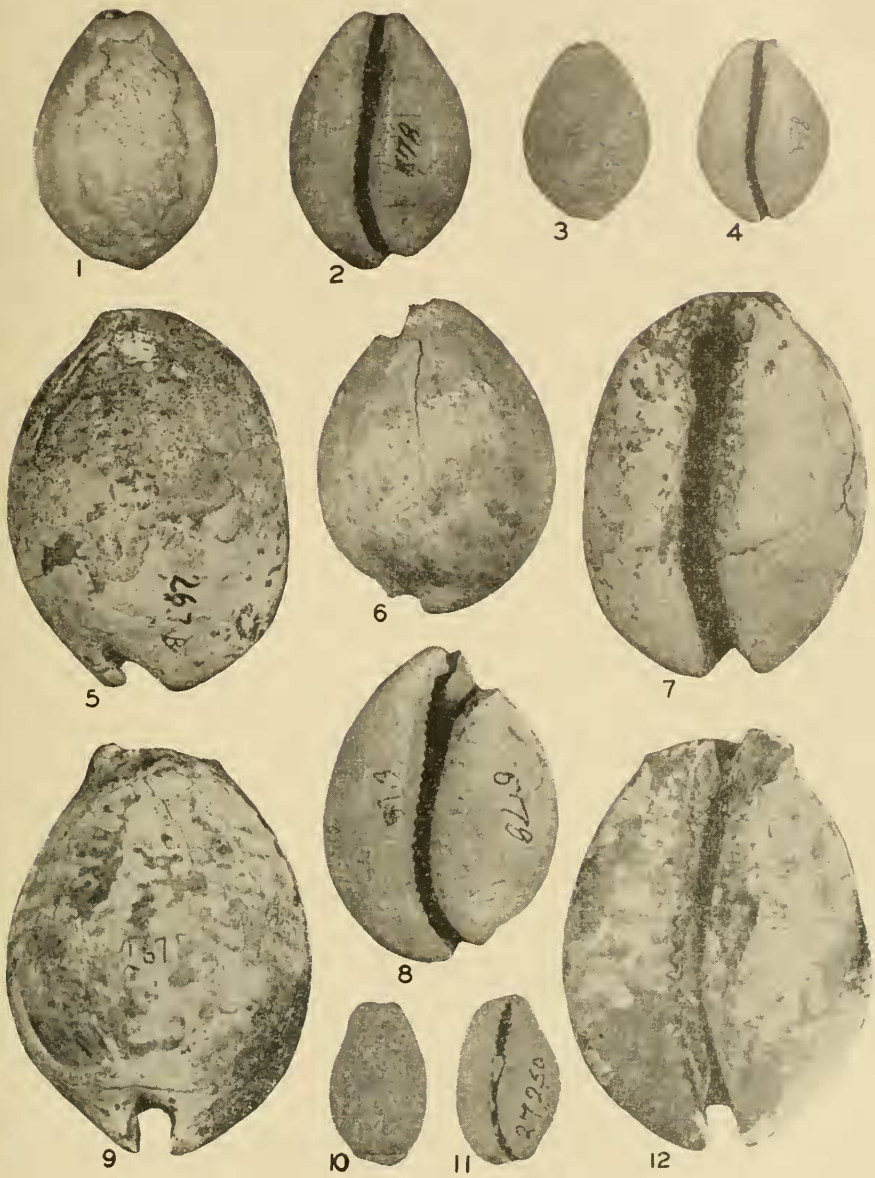
FIGS. 3–4.—*Cypraca alumensis* Ingram, new species. Length, 28.50 mm., breadth, 20.50 mm., height, 14.50 mm. Holotype, No. 8043, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about 20 feet above the water level, on the left bank of Apalachicola River, about 3½ miles above Bristow, at Alum Bluff on Apalachicola River, Calhoun County, Florida; lower Miocene. P. 127.

FIGS. 5, 7.—*Cypraca andersoni* Ingram. Length, 60 mm., breadth, 44 mm., height, 32 mm. Holotype, No. 8042, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 267B (C.A.S.), Tuberá Hill at west base of Tuberá Mountain, in the lower part of the Tuberá group, 1 mile west of Tuberá, Colombia; middle Miocene. P. 129.

FIGS. 6, 8.—*Cypraca apalachicolae* Ingram, new species. Length, 48 mm., breadth, 37 mm., height, 28 mm. Holotype, No. 8045, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 578 (C.A.S.), marl bed about 20 feet above the water level, on the left bank of Apalachicola River, about 3½ miles above Bristow, at Alum Bluff on Apalachicola River, Calhoun County, Florida; lower Mioicene. P. 126.

FIGS. 9, 12.—*Cypraca tuberae* Ingram. Length, 64 mm., breadth, 47.50 mm., height, 35 mm. Holotype, No. 8041, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 267B (C.A.S.), Tuberá Hill at west base of Tuberá Mountain, in the lower part of the Tuberá group, 1 mile west of Tuberá, Colombia; middle Miocene. P. 129.

FIGS. 10, 11.—*Cypraca darwini* Ingram, new species. Length, 26 mm., breadth, 16 mm., height, 13.50 mm. Holotype, No. 8046, Calif. Acad. Sci. Paleo. Type Coll., from Loc. 27250 (C.A.S.), old beach deposit along beach, probably 5 feet thick, bay on northwest part of island on west side, South Seymour Island, Galapagos Islands, Subfossil. P. 144.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